DOCUMENT RESUME

ED 180 426 HE 012 222

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TITLE Women in Computer Sciences.
PUB DATE [79]
NOTE 11p.

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Career Awareness: *Career Opportunities: *Computer Oriented Programs: *Computer Science: Employment Opportunities: *Employment Projections: *Females: Higher Education: Management Information Systems: *Womens Education

ABSTRACT

The keynote address of a conference that focused on the future of women in science and engineering fields and the opportunities available to them in the computer sciences is presented. Women's education in the sciences and education and entry into the job market in these fields has steadily been increasing. Excellent employment opportunities are available for women in computer occupations, a relatively new field. Programmers and system analysts will continue to be needed as an increasing number of hospitals automate food services and computerize patient records, and tremendous growth is also expected in education. Service bureaus and computer maintenance firms will also contribute heavily to the overall growth of computer occupations in industry. State and local governments will be developing consolidated systems serving a greater variety of information processing needs and will increase to a great extent their use of terminal networks and other data communications technology in their operations. The field of computer science is expanding and computer technology is being applied innovatively in a wide range of creative areas such as dance, literature, and history. Abilities of individuals in the computer sciences and some advantages of working in this field are noted. (SW)

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"WOMEN IN THE COMPUTER SCIENCES"

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From the spring of 1977 to December, 1978, the Evaluation and Training Institute was involved in a national study of the graduate enrollment and academic employment of women in the sciences and engineering. The study consisted of two parts: The first included statistical analyses of the institutional distributions of men and women employees and students in the fifty leading doctorate granting schools in the United States, those schools reporting the largest number of full-time science and engineering personnel on the National Science Foundation Survey of Scientific and Engineering Personnel Employed at Universities and Colleges for 1976. The second phase of the study involved site visits to nine of the fifty schools, during which interviews were conducted with administrators, faculty, and students to gather qualitative data on the status of women in scientific fields.

During the course of the final site visits, the concerned chairman of the computer sciences department came to our interview team and asked what he personally could do to help women interested or involved in the computer sciences fields. Our suggestion to him was that he sponsor a career day for women who were interested in the computer sciences. Similar programs have been sponsored by the National Science Foundation

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throughout the country to stimulate the participation of women in the various scientific fields. Conference participants meet with women scientific professionals and science educators to learn what training is required and what career possibilities exist for the various scientific disciplines.

To the credit of the department chairman, Dr. Ellis Horowitz of the University of Southern California, work began immediately on implementing our suggestion, and on October 7, 1978, the Women's Career Day in Computer Science was held at USC. To our knowledge this was the first conference specifically in the computer sciences field offered for women. The conference was publicized through the press and publications sent to local colleges and high schools. Several women working in the computer field in management and supervisory positions were recruited to present small group seminars on the problems and possibilities women encounter in the computer field. Among the speakers, Ms. Betty Nimi of TRW discussed opportunities in technical management for women, Dr. Christine Montgomery of Operating Systems Inc., described opportunities in small computer software, and Dr. Erica Rounds of Technology Service Corporation spoke on careers in computers and image processing.

The following is the keynote address of the conference which focuses on the future of women in science and engineer-

ing fields, and the opportunities available to them in the computer sciences. In order to increase the number of women involved in this field women must be made aware of the possibilities offered.

One of our friends, a practicing attorney, was driving with her young son when they saw a woman driving a large truck in the next lane. Pointing and laughing, her son said, "Oh look, Mommy, a lady truck driver!" "And what's so funny about that?" our friend said, ready to give her clearly chauvinistic offspring a severe lecture on female equality. Unshaken by her disapproving tone, her son replied, "I didn't know ladies could be truck drivers; I thought they all were lawyers."

That story is true, and equally true is the fact that "ladies" are today becoming lawyers, doctors, engineers, veterinarians, architects, plumbers and truck drivers in record numbers. Certainly, we are a long way from an androgenous society, with full equality for women, but it is becoming increasingly more difficult for little boys and girls to grow up thinking that women's roles are confined to being wives, mothers and public school teachers.

Women now comprise over half of the total undergraduate enrollment in the United States, and increasing proportions of masters, doctorates and professional degrees are being

earned by women. The percent of women receiving medical and veterinary degrees has more than doubled since 1970 -- to 16% and 18% respectively. The proportion of women receiving degrees in law went from 852 in 1969 -- 5% of the total -- to 6,264 in 1977, almost 20% of the total degrees awarded in law. The number of women doctorates increased by 276% between 1966 and 1976, with an all-time high in 1976 of 23%. We have truly come a long way, and nowhere is this more evident than in the sciences and engineering. In these traditionally masculine strongholds, women received 17% of the doctorates awarded in 1976 compared to less than 13% in 1968.

In part, women are responding to organized, affirmative actions of schools to recruit women into the sciences. Career days, such as this one, or conferences sponsored by the National Science Foundation's Women in Science program, are being held on college campuses all over the country to introduce women to the different specialties within the sciences and to provide information about careers for women in occupations that traditionally have not attracted or accepted women. Private industry has provided large amounts of financial support for films, brochures and other materials designed to acquaint women with the enormous opportunities available for them in various scientific professions.

Women across the country are also responding for the first time to the job market. Without question, the most

widespread demand today, according to the Engineer/Scientist Demand Index, is for women and minorities. It is interesting to note that as recently as 1974, in a survey of 182 companies and government agencies recruiting engineers on college campuses, one-third of the employers said that they would not consider hiring women because the jobs they were offering were not suitable for women, most of whom "lacked strong career commitment." Today, the opportunities awaiting women in engineering and the sciences in all areas of industry, government and education are almost limitless. Starting salaries offered to women graduates in science and engineering even at the bachelor's level are excellent, and in some cases exceed those offered to men. Women scientists/engineers with a Ph.D are at a premium.

Excellent employment opportunities are available for women in computer occupations. Compared to traditional disciplines such as physics, chemistry or engineering, computer science is a relatively new field. Various mechanical devices have been used to help people process data throughout history, beginning with the abacus thousands of years ago. But it was not until 1937, when the first automatic computing device was developed by Dr. Howard Aiken at Harvard University, that a "field" of computer science began to develop and a wide range of trained personnel became needed. Systems analysts and programmers in particular are among the most

rapidly growing professional and technical occupations in the economy, with the most rapid employment increase expected in hospitals, educational institutions and data processing services. Programmers and system analysts will continue to be needed as an increasing number of hospitals automate food services and computerize patient records. Medical information and communication systems are expected to grow as will computerized systems for medical diagnosis and instruction.

Tremendous growth is also expected in education. Manpower requirements for computer-assisted instructional systems, automated library operations, such as acquisitions and cataloguing, automated administrative services including class scheduling, student record maintenance and enrollment will assure the need for computer specialists in the educational sector.

Service bureaus and computer maintenance firms will also contribute heavily to the overall growth of computer occupations in industry. Computerized ordering and inventory systems by wholesalers will speed the growth of computer manpower requirements in wholesale and retail trade, and computer manpower requirements in government will increase dramatically over the next decade as new information systems are installed and existing ones expand their capabilities. State and local governments will be developing consolidated systems serving a greater variety of information processing needs and

will increase to a great extent their use of terminal networks and other data communications technology in their operation.

The field of computer science is expanding and computer technology is being applied innovatively in a wide range of creative areas such as dance, literature and history. The computer has been used to generate instructions for ballet dancers since 1964. It aids choreographers and dancers to visualize body movements and allows them to "practice" various routines quickly on the computer rather than taking days of actual practice. The storage capacity and speed of the computer is being applied to help the scholar describe and critique literary work, and to track the development of style and ideas in literature and history.

Clearly, computer occupations will continue to grow, and the increasing sophistication and complexity of computer personnel functions will require workers with greater amounts of specific computer related training than was formerly true. In the past, women have tended to occupy the lower level jobs in computing, most particularly keypunching and simple programming. Now, and increasingly in the future, systems analysts, who have always been in great demand, will be sought after even more intensely. And women can and will seek the training to occupy these positions.

According to the projections of experts and educators in

the area today, computer science and engineering graduates of the 80's will have completed a 4 or 5 year program in computer science and engineering at a major university. They will have a strong mathematical ability, a knowledge of classical electrical/electronic engineering, a moderate familiarity with computing, heavy "hands on" experiences with digital systems, and a complete working knowledge of software engineering techniques. They will be well-versed in the technical, ethical and economic aspects of the computer industry and may have spent time in an apprenticeship or internship in industry. Equally important, they will be able to communicate with people as well as the computer, serving as translator between the computer and the people with the problems to solve. A tall order, maybe; but women can do it. They have always excelled in communication skills and they can master the technical skills required to work with the computer, even those that are based on a solid knowledge of mathematics.

In the course of our study of women scientists and engineers employed and enrolled in graduate school in colleges and universities, we heard faculty and department heads say time and time again that women did not have the background or interest in mathematics. Many studies have shown that as girls progress through school, their interest in mathematics diminishes, starting as early as sixth grade and continuing through junior and senior high school and college. Various explana-

tions have been offered, including biological theories that women don't have the right hormones or the right brain structure for mathematical problem solving. But most of these theories have been thoroughly discredited and more recent research indicates that fewer women than men pursue math not because of differences in ability but because boys are more aware than are girls that such courses are necessary prerequisites for the kinds of careers they have planned in technological fields.

Unfortunately, lack of exposure to math often creates in many people the fear of the unknown which carries over to the computer, that awesome machine that seems to have such extraordinary powers. Neither math nor the computer are too difficult to understand and you don't have to be a genius to do so. A math textbook is no more incomprehensible than is a book written in English to someone who speaks a totally different language. And that is basically what math is -- a different language which can be learned and understood. The computer, recently described as a "high-speed idiot," can also be learned and understood.

Computer Sciences offers women unique opportunities to be creative -- to solve engineering problems, environmental problems, interdisciplinary problems of interest to society. They can also bring other disciplines to bear, using their combined skills in the areas of dance, literature and his-

tory. The computer science field also offers flexibility in scheduling not present in all technical fields. Part-time programming work or consulting jobs which offer short term jobs with challenge as well as excellent pay allow women to continue working in the field even if they want to stay home and raise a family.

The purpose of this program is not to talk you all into becoming computer scientists but to give you an idea of the many exciting options available in the field. As I said at the beginning, women are more than ever before beginning to move into areas of science and engineering. But it is only a beginning and we need many, many more of you before we really can achieve equality in the world of science. So please join us and let us answer your questions and help you explore <u>all</u> of the alternatives available to you.